**Upgraded Injector**

**Test Facility**

**Accelerator Readiness Review Plan**

**Date and Time TBD**





**REVISION SUMMARY**

|  |  |  |
| --- | --- | --- |
| **Revision** | **DATE** | **Description** |
| **0** | 9/13/16 | Initial plan development |
| **1** | 1/27/17 | Revised Charge to the Team, CRAD/LOI, TOC |
| **2** | 2/20/17 | Final DRAFT to be used as a template for UITF ARR |

**REVIEW**

|  |  |
| --- | --- |
| **Associate Director, ESH&Q**…………………………….......................... | Mary Logue  |
| **Safety Configuration Management Board (SCMB)**………….……….. | Paul CollinsHarry FanningBob May – ChairHenry RobertsonGreg SmithSteve SuhringVashek Vylet |

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# Executive Summary

This Accelerator Readiness Review (ARR) Plan was developed to facilitate the review to verify Jefferson Lab’s readiness to safely commission and operate the Upgraded Injector Test Facility (UITF). This plan guides the ARR process in such a way that it is conducted according to the requirements of Department of Energy (DOE) Order (O) 420.2C, Safety of Accelerator Facilities and that it is consistent with the Accelerator Facility Safety Implementation Guide for DOE O 420.2C, Safety of Accelerator Facilities. This plan was developed according to Jefferson Lab’s QACI-041 – “Accelerator Readiness Review Program” which states that a substantial upgrade or change to an existing facility is sufficient reason to conduct an ARR. The upgrade to the Injector Test Stand constitutes sufficient reason.

# Scope

This plan considers the process by which verification of hardware, personnel, and procedures, associated with commissioning and routine operations, are determined to be ready to permit activities to be undertaken so the facility can move safely through a logical commissioning sequence until full operation is achieved. This is an overview and sampling process, not an extensive wall-to-wall assessment. It is expected that a series of structured internal reviews will precede the ARR and provide the extensive review that the ARR will sample.

The ARR will addresses accelerator specific hazards associated with the following topical areas:

* Ionizing and non-Ionizing Radiation
* Electrical Hazards
* Fire Hazards
* Pressure and Vacuum Hazards
* Cryogenics and Oxygen Deficiency Hazards
* Magnetic Fields
* Other Mechanical, Chemical, and Gaseous Hazards

The ARR will address the application of configurations management, particularly with respect to computer and software controls that have safety significance. The ARR will address conduct of operations as it relates to routine accelerator operations and maintenance, the conduct of safe operations as it relates to experimental nuclear physics – from experiment proposal phase to the installation, operation, and removal of experimental equipment – and actions to be taken in emergent situations.

 This ARR Plan provides guidance, based on a graded approach, as to the extent of review associated with topical areas. Depending on the nature of a hazard and the extent to which its profile has changed, the scope of the ARR will vary. This will be evident in the extent of the review of the topical areas, the criterion for determining readiness, and the depth of inquiry used to evaluate a particular criterion.

# The Accelerator Readiness Review Process

## Selection of an ARR Team

Jefferson Lab has assembled a team of internal experts, supported by one or more external experts, to conduct the ARR. The team consists of individuals chosen for their expertise in key aspects of accelerator organization, operation, experimental physics, and safety, and sufficiently removed from areas under review to avoid conflicts of interest. This supports a level of scrutiny that may not be readily achieved by external experts alone.

ARR Team members were recommended for approval by the Associate Director – Environment, Safety, Health, and Quality (ESH&Q) to the Laboratory Director. Approved team members were reviewed by the Safety Configuration Management Board (SCMB), an independent review board approved by the Laboratory Director. The SCMB is responsible for oversight of safety configuration management and the process by which the laboratory evaluates Unreviewed Safety Issues (USI).

## Team Member, Affiliation, and Focus Area(s)

Approved team members include the following:

|  |  |  |
| --- | --- | --- |
| **Member** | **Affiliation** | **Focus Area** |
| Bob May | Jefferson Lab | *ARR Process Facilitator* |
| Ken Baggett  | Jefferson Lab |  |
| Harry Fanning | FRIB |  |
| Peter Grivens | Jefferson Lab |  |
| Elton Smith | Jefferson Lab |  |
| Bob Sperlazza | Jefferson Lab |  |

The DOE Thomas Jefferson Site Office (TJSO) will observe and provide DOE oversight of this ARR at various times:

* Patty Hunt, TJSO
* Steve Neilson, TJSO

See Appendix B for the specific charge communication from the Laboratory Director to the ARR Team.

## Prerequisite Documentation

The ARR depends on a certain level of organizational maturity and analyses to accurately characterize hazards associated with facility operations. The following documentation, Located in Appendix A, is provided to team members:

* **Safety Assessment Document (SAD)** – provides an analysis and is pertinent to understanding the risks of accelerator operation. The SAD performs the following functions:
	+ Identifies hazards and associated on and off-site impacts to workers, the public, and the environment from facility operations both normal and credible events.
	+ Contains sufficient descriptive information and analytical results of specific risks to ensure understanding of the hazards.
	+ Provides detailed descriptions of engineered controls (e.g., interlocks and physical barriers) and administrative measures (e.g., training) in place that eliminate, control, or mitigate hazards from operation.
	+ Includes, or references, descriptions of facility function, location, management organization, components, and operation.
* **Accelerator Safety Envelope (ASE)** – approved by the DOE, the ASE defines the physical and administrative bounding conditions and controls for safe operations based on the safety analysis documented in the SAD. Any activity expected to exceed the bounding conditions of the ASE requires DOE approval. Any activity violating the ASE is terminated immediately and be put in a safe and stable configuration.
* **Unreviewed Safety Issue (USI) Process** – describes the process by which to identify conditions or activities that would present a significant increase in the probability of exceeding the bounding conditions of the ASE. Activities could be either planned modifications or conditions that could result in a significant adverse impact.
* **Contractor Assurance System (CAS)** – maintains the internal assessment process.
* **Safety Configuration Management Program** – includes procedures for ensuring accelerator safety. Consists of the following programs:
	+ Configuration Management Process – defines how consistency of a system or product’s performance, requirement, and operation are maintained throughout its life.
	+ Quality Assurance Plan for the 12 GeV Upgrade – describes the configuration management process for this upgrade.
	+ Conduct of Engineering Manual – provides procedures and processes by which engineering designs are managed within the scope of requirements.
* **Commissioning Plan** – describes:
	+ Roles, responsibilities, accountabilities, and authorities of managers, supervisors, and operators for carrying out the commissioning/operations. Staffing schedules, authority, and reporting chain for operational, safety, and scheduling issues.
	+ Procedures (normal and emergency/contingency), administrative controls, and personnel training (including records and qualification for commissioning at the stated intensity).
	+ Engineered safety systems that operate for the accelerator and accelerator-associated experimental facilities.
	+ Operational characteristics of specific facilities, sub-systems, and modes of commissioning needed to support the safety case for progressively higher power commissioning.

See [Appendix 2](#_Appendix_2:_) for links to Prerequisite Documentation. These documents are provided for reference. ARR Phase 1a and 1b related to the 12Gev Upgrade and will not be review again as part of the UITF ARR.

## Schedule

The following tables list the schedule for the review, the Topical Areas, and the speakers that will discuss the Topical Areas and lead a walk-down of the relevant equipment and locations.

**SUGGESTED SCHEDULE**

**Table 1: Day 1 AM, Date**

| **Session** | **Session Title** | **Reviewer** | **Observer** |
| --- | --- | --- | --- |
| **1** | **2** | **3** | **4** | **5** |  |  |  | **1** | **2** |
| **AM** | **(Location and Room Number)****In-brief and Joint Sessions 1 - 4** |  |  |  |  |  |  |  |  |  |  |
| **0800-0815** | **In-brief** | **X** | **X** | **X** | **X** | **X** |  |  |  | **X** | **X** |
| 0815-0900 | Session 1: ARR Plan and Process for the Review | X | X | X | X | X |  |  |  |  |  |
| 0900-0930 | Session 2: Facility Safety Basis (SAD, ASE, USI) | X | X | X | X | X |  |  |  |  |  |
| 0930-1015 | Session 3Accelerator Commissioning Plan (including L/L from CEBAF/LERF) | X | X | X | X | X |  |  |  |  |  |
| **Break** |  |  |  |  |  |  |  |  |  |  |  |
| 1030-1145 | Session 4: Accelerator Conduct of Operations |  |  |  |  |  |  |  |  |  |  |
| **Working Lunch** | **Location – CEBAF Center** | **X** | **X** | **X** | **X** | **X** |  |  |  |  |  |

**NOTE: Use an “x” to indicate which reviewers / observers are covering which sessions...** **Day 1, PM, Date**

|  |  |  |  |
| --- | --- | --- | --- |
| **Session** | **Session Title** | **Reviewer** | **Observer** |
| **1** | **2** | **3** | **4** | **5** |  |  |  | **1** | **2** |
| **PM** |  |  |  |  |  |  |  |  |  |  |  |
|  **(Location and Room Number)**  **Technical Sessions 5 – 8**  |  |  |  |  |  |  |  |  |  |  |
| 1315-1400 | Session 5:Commissioning Integration/Resources  |  |  |  |  |  |  |  |  |  |  |
| 1400-1445 | Session 6:Operator Training, In-situ Discussion and Process Observation |  |  |  |  |  |  |  |  |  |  |
| **Break** |  | X | X | X | X | X |  |  |  |  |  |
| 1500-1545 | Session 7:Control Room Discipline Staffing, In-situ Discussion, Schedule Review, and Process Observation |  |  |  |  |  |  |  |  |  |  |
| 1545-1630 | Session 8:Accelerator Controls and Controls Software QA/Cyber Security |  |  |  |  |  |  |  |  |  |  |
| **1630-1730** | **ARR Team Executive Session**  | **X** | **X** | **X** | **X** | **X** |  |  |  |  |  |

**NOTE: Use an “x” to indicate which reviewers / observers are covering which sessions..** **Day 2, AM, Date**

|  |  |  |  |
| --- | --- | --- | --- |
| **Session** | **Session Title** | **Reviewer** | **Observer** |
| **1** | **2** | **3** | **4** | **5** |  |  |  | **1** | **2** |
| **AM** | **Technical Sessions 9-13** |  |  |  |  |  |  |  |  |  |  |
| **0800-0815** | **(Location and Room Number)** | **X** | **X** | **X** | **X** | **X** |  |  |  | **X** | **X** |
| **Technical Session** |  |  |  |  |  |  |  |  |  |  |
| 0815-0900 | Session 9:Safety Systems -Access Controls, Beam Containment (Credited Controls / Configuration Management) |  |  |  |  |  |  |  |  |  |  |
| 0900-0930 | Session 10:Commissioning Plan implementation and Hot Checkout |  |   |  |  |  |  |  |  |  |  |
| 0930-1015 | Session 11:Experiment Conduct of Operations (Installation, Commissioning, Operations, and Decommissioning) |  |  |  |  |  |  |  |  |  |  |
| **Break** |  |  |  |  |  |  |  |  |  |  |  |
| 1015-1115 | Session 12: Site visit | X | X | X | X | X |  |  |  | X | X |
| 1115-1145 | Session 13:Radiation Protection, Monitoring, Shielding Configuration Management |  |  |  |  |  |  |  |  |  |  |
| **Working Lunch** |  | **X** | **X** | **X** | **X** | **X** |  |  |  |  |  |
| **PM** | **Technical Sessions 14-15** |  |  |  |  |  |  |  |  |  |  |

**NOTE: Use an “x” to indicate which reviewers / observers are covering which sessions...**

**Day 2, PM, Date**

|  |  |  |  |
| --- | --- | --- | --- |
| **Session** | **Session Title** | **Reviewer** | **Observer** |
| **1** | **2** | **3** | **4** | **5** |  |  |  | **1** | **2** |
| **PM** | **Technical Sessions 14 - Closeout** |  |  |  |  |  |  |  |  |  |  |
| 1315-1400 | Session 14:Industrial Safety Issues | X | X | X | X | X |  |  |  |  |  |
| 1400-1445 | Session 15:Reserved / homework | X | X | X | X | X |  |  |  |  |  |
| 1445-1600 | **ARR Team Executive Session and Report Writing** | X | X | X | X | X |  |  |  |  |  |
| **1630-1730** | **Closeout** | **X** | **X** | **X** | **X** | **X** |  |  |  | **X** | **X** |

**NOTE: Use an “x” to indicate which reviewers / observers are covering which sessions...**

**Table 2: List of Talks and Responsible Jefferson Lab Staff**

| **Session Title and Contents** | **Responsible Jefferson Lab Staff****(producing/delivering talks and leading****in-field reviews and discussions)** |
| --- | --- |
| **Joint Sessions** |  |
| Session 1: ARR Plan and Process for the Review | Talk: Author 1 |
| Session 2: Facility Safety Basis (SAD, ASE, USI) | Talk: Author 1 |
| Session 3Accelerator Commissioning Plan (including L/L from CEBAF/LERF) | Talk: Author 2 |
| **Technical Session** |  |
| Session 4: Accelerator Conduct of Operations | Talk: ... |
| Session 5:Commissioning Integration/Resources  |  |
| Session 6:Operator Training, In-situ Discussion and Process Observation |  |
| Session 7:Control Room Discipline Staffing, In-situ Discussion, Schedule Review, and Process Observation |  |
| Session 8:Accelerator Controls and Controls Software QA/Cyber Security |  |
| Session 9:Safety Systems -Access Controls, Beam Containment (Credited Controls / Configuration Management) |  |
| Session 10:Commissioning Plan implementation and Hot Checkout |  |
| Session 11:Experiment Conduct of Operations (Installation, Commissioning, Operations, and Decommissioning) |  |
| Session 12: Site visit | Tour: |
| Session 13:Radiation Protection, Monitoring, Shielding Configuration Management |  |
| Session 14:Industrial Safety Issues |  |
| Session 15:Reserved / homework |  |

# Accelerator Readiness Review Conduct

## Expected Accelerator Parameters

Table 3 lists the expected operational parameters, subsequent to TJSO approval, for UITF commissioning and operational activities.

Table 3 – Operating Parameters for UITF Commissioning and Operation

|  |  |  |  |
| --- | --- | --- | --- |
| **ARR Phase** | **Beam Termination** | **Beam Current** | **Beam Energy (MeV)** |
| Commissioning | Beam to Injector In-line Dump |  |  |
| Beam to HDIce | 1 nA | 10 |
| Operation | Beam to nuclear physics target station | 100 nA | 10 |

## Methodology

The general method for evaluating systems (including supporting documentation, procedures, and training) is to first review the documentation identified in Appendix A (hotlinks are imbedded). Then the review committee can answer the Charge questions in Appendix B using the specific Criterion for Readiness (CRAD) that the supporting Lines of Inquiry (LOI). The ARR Team is tasked, using a graded approach, to evaluate whether the accelerator is capable of operating safely and in accordance with the requirements in the Accelerator Safety Order. This evaluation will be made on the basis of presentations, field observations, and personnel interviews. Jefferson Lab will make the resources available to ensure that the ARR Team has access to people, equipment, and can observe process where needed.

### Presentations

Systems/subject matter experts (SME) will present an overview of accelerator facilities and subsystems. Each SME will describe the function and hazards of a designated system. When a system interfaces with one or more credited controls identified in the ASE, the credited control(s) and the nature of the interface will be described.

The SMEs will also present or refer to evidence that equipment was installed and functionally tested, properly documented, and resources and procedures are in place, in order to ensure that the system can be maintained and operated as intended.

### Field Evaluations

Team members will conduct field evaluations to inspect a sampling of installed credited controls along with the evidence that they are indeed fully operational, documented, and that training has been developed and implemented, or is on schedule. A graded approach will be used to select the systems and processes.

### Interviews

Team members will conduct field interviews with SMEs. The SMEs will be available to discuss information made available during presentations and field evaluations. SMEs may be called to clarify information and to answer question that develop during the review. These interviews may take place in the filed or in executive sessions as ARR Team members are attempting to clarify issues and develop recommendations.

## Recordkeeping

A computer documentation system is provided to support the ARR Team. It is located at https://misportal.jlab.org/arpt. The system is linked to the results of pre-Hot Checkout reviews where SMEs certify readiness of their system(s) and link evidence to support this claim. The ARR team can access the system, inspect the certification and documentation, and verify or question the SME(s). The tool is supported by the Quality Assurance/Continuous Improvement (QA/CI) Department in Environment, Safety, Health, and Quality (ESH&Q) Division and the Management Information System (MIS) Department.

## Reporting

The ARR Team will provide a report to the Laboratory Director determining whether the lab is ready to commission the accelerator and will include findings, deficiencies, or recommended activities prerequisite to commissioning. The report will address the presented CRADs, associated LOIs, and document the ARR Team’s activities.

# Abbreviations, Acronyms, and Definitions

**ABIL (Accelerator Bypassed-Interlock Log)** – A web-based log that lists bypassed interlocks presently installed in accelerator systems. ABIL also includes the policy and process that defines how interlocks must be bypassed.

**ARR (Accelerator Readiness Review)** – A required, structured review process to verify that hardware, personnel, and procedures associated with commissioning or routine operations are ready to permit the activity to be undertaken safely (DOE Order 420.2C). At the completion of the ARR process, the Laboratory Director will authorize beam operations, and the DOE site office will concur via a formal letter to the Director of Accelerator Operations.

**ASE (Accelerator Safety Envelope)** – An overarching safety document, published in accordance with the DOE Accelerator Safety Order that provides bounding conditions and limitations within which the CEBAF accelerator must be operated to assure the safety of workers, the environment, and the public.

**ASO (Accelerator Safety Order)** – DOE document DOE-420.2c, which addresses accelerator safety.

**ATLis (Accelerator Task List)** – A web-based work planning tool used to submit, review, approve, and schedule CEBAF maintenance tasks.

**ATLis Work Map** – A web-based visual tool that depicts work going on around the accelerator site on a day-by-day basis. Descriptive text and icons overlaying a map of the accelerator help identify busy areas and encourage coordination of overlapping tasks.

**Beam Authorization Form** – Must be completed and entered into the CEBAF electronic logbook by the Director of Accelerator Operations before running beam in an accelerator segment.

**Beam Test Plans** – Generally single-use procedures written by system experts to test specific accelerator operating parameters and to gather test data during beam operations. Test plans are written, submitted, and approved using an on-line form that is a part of the web-based ATLis work planning system. During 12 GeV commissioning, Beam Test Plans will be used to supplement the Commissioning Plan and standard operating procedures.

**CAS (Contractor Assurance System)** – DOE-required internal system to manage Jefferson Lab performance consistent with contract requirements.

**CASA (Center for Advanced Studies of Accelerators)** – An organization of scientists and technical personnel with the broader goal of pursuing a program of theoretical and experimental research in accelerator and beam physics. A subset of this group comprises the B-Team, with responsibility for meeting 12 GeV beam transport and beam specification goals.

**UITFED (UITF Element Database)** – A database that defines all operational elements of the accelerator, both in the tunnel and in the service buildings.

**CHL (Central Helium Liquefier)** – Helium refrigerator located inside the accelerator ring; provides cooling for super-conducting components.

**CI (Continuous Improvement)**

**CMP (Configuration Management Program)** – Establishes consistency among design requirements, physical configuration, and documentation (including analysis, drawings, and procedures) for the activity, and maintains this consistency throughout the life of the facility or activity, particularly as changes are being made.

**CRAD (Criterion Review and Approach Document) –** Statements which summarize a program’s requirements

**Credited Controls** – Identified in the FSAD, these are used to mitigate hazards posing unacceptable risks and assure the safety of workers, the public and the environment. Credited controls are listed in the ASE.

**CW Mode Beam** – Continuous-wave beam, 100% duty factor.

**DOE (Department of Energy)**

**ESH&Q (Environment, Safety, Health and Quality)**

**FML (Facilities Management and Logistics)** – Jefferson Lab organization responsible for performing or specifying performance of all Jefferson Lab facility maintenance, construction, security, property, and facility services.

**FSAD (Final Safety Assessment Document)** – This document provides a qualified safety assessment of the hazards specific to CEBAF and defines the measures used to mitigate those hazards to safe levels. The FSAD does not address common industrial hazards.

**Gun HV** – High voltage supplied to the electron gun in the injector.

**HCO (Hot Checkout)** – The period immediately before beam operations when required systems are systematically checked without beam. The Restoration Coordinator (RECO) coordinates HCO activities.

**UITF CP (Upgraded Injector Test Facility Commissioning Plan)**

**ISMS (Integrated Safety Management System)** – A safety management system established to systematically integrate safety into management and work practices at all levels of the organization.

**LCW (Low Conductivity Water)** – Specially purified water is used to hold accelerator components at a consistent temperature.

**LLRF (Low-Level Radio Frequency)** – controls for cryomodule control systems.

**LOI (Lines of Inquiry)** – Questions or guidance to objectively determine if requirements have been satisfied.

**MAC Training (Machine Access Control Training)** – is a subset of the standard Crew Chief/Operator training that must be taken by accelerator scientists or technical personnel who, when beam is present in the accelerator, need to make control system changes that will affect beam transport.

**MIS (Management Information System)**

**Moodle** – A web-based, open source learning management system used by MCC Operations to deliver Operator, Crew Chief, and MAC training.

**MPS (Machine Protection System)** – Software/hardware that protects equipment from damage by beam operations. Includes the BLM (beam loss monitoring), BCA (beam current accounting), and FSD (fast shutdown) systems.

**O (Order)**

**PSS (Personnel Safety System)** – Software/hardware system of access control, interlocks, and warning devices dedicated to personnel protection from hazards associated with CEBAF accelerator operation.

**QA (Quality Assurance)**

**RPP (Radiological Protection Plan)**

**SCMB (Safety Configuration Management Board)**

**SME (System/Subject Matter Expert)**

**Songsheets** – Accelerator drawings maintained by the Mechanical Engineering Division that show the beamline and all major beamline components.

**SRL (Skill Requirements List)** – A web-based tool used lab-wide to define required training for each employee.

**TJSO (Thomas Jefferson Site Officer)** – Primary DOE representative at Jefferson Lab Site Office.

**Tune Mode Beam** – Low power, low duty factor (1.5%) beam with a 250 μs, 60 Hz pulse structure used to tune the accelerator during commissioning. All insertable dumps are capable of safely absorbing this power level.

**UITF OD (UITF Operations Directives)** – A document that provides directives for those who operate and maintain the CEBAF accelerator and the associated beam-delivery systems. Required control room staffing levels and critical event response protocols are included.

**USI (Unreviewed Safety Issue)** – An accelerator safety issue that presents a significant safety risk and was not previously identified, analyzed, and already mitigated as documented in the FSAD.

**Viewer Limited Mode Beam** – A very low duty factor beam mode that is automatically enabled when an insertable device (e.g., a beam viewer) is inserted into the beam path.

# **Appendix A: Pre-requisite Documentation**

| **Document** | **Jefferson Lab Document Title** | **Location** |
| --- | --- | --- |
| B1Safety Assessment Document  | Thomas Jefferson National Accelerator Facility Final Safety Assessment Document Revision 7, August 27, 2012 | <https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-21395/FSAD%20REV%207%20%28110512%29.pdf> |
| B2Accelerator Safety Envelope | Thomas Jefferson National Accelerator Facility Accelerator Safety Envelope Revision 7, November 1, 2012 | <https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-62667/ASE%20REV7%20%28Dated%20110112%29.pdf> |
| B3Unreviewed Safety Issues | Identifying USI Procedure | M:\scmb\0Logistics\Identifying USI Procedure.rtf |
| SCMB USI Screening | M:\scmb\0Logistics\ SCMB USI Screening.docx |
| B4Contractor Assurance System | Jefferson Science Associates, LLC, Contractor Assurance System Description for the Thomas Jefferson National Accelerator Facility, September 2012 | <https://misportal.jlab.org/InsightWebProject/docushareDownload/Approved_CAS_Program_Description.pdf?handleIndex=41240&fileName=Approved_CAS_Program_Description.pdf> |
| B5Safety Configuration Management | Configuration Management Governance Procedure, QA44 | <https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-49425/Config%20Mgmt%20%28Smith%2012-14-11%29%20posted%20version%201-5-2012.docx> |
| Supplemental QAP for 12 GeV CEBAF Upgrade | <https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-23922> |
| Conduct of Engineering Manual ENG-AD-01-001 Revision A | M:\scmb\0Logistics\ ENG-AD-01-001 - Conduct of Engineering Manual - rev A.docx |
| B6 Commissioning Plan | Under development |  |

# Appendix B: Charge to the ARR Team

The members of the Accelerator Readiness Review (ARR) Team will determine if Jefferson Lab, is prepared to deliver beam for the commissioning and operation of the Upgraded Injector Test Facility (UITF) in a safe and efficient manner consistent with the requirements of DOE O420.2C, Safety of Accelerator Facilities. The review shall include experimental equipment that is constructed and tested but which may not be installed in its final configuration at the time of the ARR.

Based on criteria in the ARR Plan, the ARR Team will verify that the personnel, documentation, and equipment are adequate to support the scope of proposed activities. The ARR Team will determine if the necessary program elements, consistent with the accelerator safety order and current guidance, are incorporated as part of the commissioning process and operational plans.

The ARR Team will base the determination on a review of key documentation and programs, focused reviews of systems and activities, interviews of staff, and a performance-based overview and sampling of the full scope of the proposed activities.

Key documentation will be provided to the ARR Team in advance: an ARR Plan, an Accelerator Commissioning Plan, documentation associated with completed Experimental Readiness Reviews, and any other recent relevant internal review conducted by Accelerator or Physics Division.

The ARR Plan will incorporate the following criteria:

1. Commissioning and operational procedures necessary for the safe and effective beam commissioning and operation of UITF by laboratory staff and experimental physics users have been developed, reviewed, and approved, and an appropriate process for the development, review, and approval of new and revised procedures is in place.
2. UITF infrastructure, support equipment, and associated experimental apparatus necessary for the safe and effective beam commissioning and operation are properly installed, functionally tested, and appropriately documented.
3. There are sufficient staff and users appropriately trained on procedures for beam commissioning activities, normal operations, and for abnormal or emergency situations for beam delivery to UITF.
4. Equipment and systems having safety significance for beam delivery for UITF meet the criteria established in the FSAD, are fully operational, and are managed as part of the laboratory's configuration management process and all requirements for the intended activities, as specified in the ASE, are met.
5. Documentation for pre-operational, operational, and post-operational activities are adequately managed and controlled.
6. Validation of the use of a team consisting of JLab ARR Team members, DOE Site Office observers, and quality control support (referred to as “The Green Team” in previous ARRs) that certifies the completion of any prestart findings.

The ARR team will develop a report to document their review of these elements. The report will be based on the scope above and review criteria established in the ARR Plan. In the report, the Team shall make a recommendation to the Jefferson Lab Director as to whether the lab is ready to complete the proposed activities. The report shall also include any findings or deficiencies and recommended activities prerequisite to the proposed activities. The ARR Team shall specify, where appropriate, the use of a “Green Team” to certify completion of any prerequisite activities. An initial close-out report shall be provided at the end of the scheduled ARR review, and the final report shall be provided within 10 business days.

# **Appendix C: CRAD and LOI Documents (Select as appropriate)**

**C1 Pre-requisite Documentation**

Each pre-requisite document undergoes a review based on specific LOIs. The status of each LOI and supporting evidence is identified. If the document meets all of the LOIs and is supported by sufficient evidence, the document is considered verified and ready for commissioning activities.

* [Safety Assessment Document](#A31SafetyAssessmentDocument) (SAD)
* [Accelerator Safety Envelope](#A32AcceleratorSafetyEnvelope) (ASE)
* [Unreviewed Safety Issues](#A33UnreviewedSafetyIssues) (USI)
* [Contractor Assurance System](#A34ContractorAssuranceSystem) (CAS)
* [Safety Configuration Management](#A35SafetyConfigurationManagement) (SCM)
* [Commissioning Plan](#A36CommissioningPlan) (CP)

## C1.1 Safety Assessment Document (SAD)

**Objective:**

Validate that there is a current, approved SAD that supports safe and effective 12 GeV accelerator commissioning and operations. Validate that the requirements in the SAD are fully understood. Validate that there is an effective process to maintain the accuracy of the information contained in the SAD.

**Criteria:**

There is an approved SAD which serves as an accurate technical basis for accelerator commissioning and operations and supports the requirements in the accelerator safety envelope. The FSAD is understood, implemented, and maintained current.

**Approach:**

**Document Reviews:** Review the facility FSAD and approvals.

**Staff/Management Interviews:** Interview selected staff involved in FSAD preparation and approvals.  Discuss FSAD update/development process, involvement of staff and DOE Site Office personnel, and the internal review process. Review general knowledge of accelerator operations staff regarding understanding of FSAD requirements.

**Performance Review:** Interview selected staff/management involved in facility management and accelerator operations to assess awareness of FSAD requirements and implementation needs.

**Performance Demonstrations:** Select one or more hazards from the FSAD Hazard Table and, during the course of the ARR, observe that the mitigations specified in the FSAD Hazard Table are implemented as described.

**Safety Assessment Document**

**Lines of Inquiry, Status/Evidence and ARR Notes**

| **LOI** | **Status/Evidence** | **ARR Reviewer Notes** |
| --- | --- | --- |
| 1. There is an approved FSAD for 12 GeV operations that meets DOE O 420.2C requirements.
 | **Status:** Thomas Jefferson National Accelerator Facility Accelerator Safety Envelope Revision 7 developed in cooperation with TJSO. Published August 27, 2012  **Evidence:** <https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-21395/FSAD%20REV%207%20%28110512%29.pdf>   * Interview selected management/staff involved in FSAD development
 |  |
| 1. The FSAD is maintained current by a process that routinely compares FSAD content to accelerator operations requirements.
 | **Status:****Evidence:*** SCMB Charter, procedures, and records
* Select one or more hazards from the FSAD Hazard Table and, during the course of the ARR, observe that the mitigations specified in the FSAD Hazard Table are implemented as described
 |  |
| 1. There is a process to evaluate unanticipated/discovered conditions against known hazards and determine if an update is necessary.
 | **Status:****Evidence:**- SCMB Charter, procedures, and records |  |
| 1. Operations staff are sufficiently familiar with the FSAD to recognize and implement requirements.
 | **Status:****Evidence:*** Interview selected management/staff to determine knowledge of FSAD requirements (include those who must operate under FSAD requirements)
 |  |
| 1. Determine adequacy of FSAD to support commissioning.
 | Basis for decision |  |

## C1.2 Accelerator Safety Envelope (ASE)

**Objective:**

Verify that there is a documented accelerator safety envelope (ASE) that meets DOE Order 420.2C requirements.

**Criteria:**

There shall be properly documented, approved, and effective ASE that will govern accelerator facility commissioning and operations.

**Approach:**

**Record Reviews:** Review extant ASE and other supporting documents to verify ASE is complete and has been reviewed and approved by TJSO.

**Interviews:** Interview TJSO and Jefferson Lab staff to participate in the processes that support the development and approval of the ASE.

**Performance Demonstrations:** Process discussion/review with selected SCMB Members: propose for SCMB, chartered responsibilities regarding Accelerator Safety Envelope compliance, evaluation of ASE effectiveness, suitability of FSAD technical basis, and possible revisions or addenda to the SAD.

| **Accelerator Safety Envelope (ASE)** **Lines of Inquiry, Status and Evidence for Each Criterion** |
| --- |
| **LOI** | **Status/Evidence** | **ARR Reviewer Notes** |
| 1. A documented ASE must define the physical and administrative bounding conditions and controls for safe operations based on the safety analysis documented in the SAD.
 | **Status:** CompleteThomas Jefferson National Accelerator Facility Accelerator Safety Envelope Revision 7, Approved by TJSO November 1, 2012**Evidence:** <https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-62667/ASE%20REV7%20%28Dated%20110112%29.pdf> |  |
| 1. The ASE is submitted to DOE for approval.
 | See 3.3.1 above |  |
| 1. An activity expected to exceed the bounding conditions of the ASE requires DOE approval.
 | See 3.3.1 above |  |
| 1. Any activity violating the ASE must be terminated immediately and be put in a safe and stable configuration (DOE notification is required).
 | See 3.3.1 above |  |
| 1. Any activity that was shut down by DOE must not recommence until DOE approves the activity.
 | See 3.3.1 above |  |
| 1. The ASE must be periodically reviewed to ensure it is maintained current and changes/updates must be supported by safety analysis in the form of a revision or addendum to the SAD.
 | * Discuss chartered responsibilities for ASE with selected SCMB members
* Review recent safety concern
 |  |
| 1. ASE supports accelerator commissioning and operation.
 | Basis for decision  | Sign off |

## C1.3 Unreviewed Safety Issues (USI)

**Objective:**

Determine if USI process provides for evaluation of operations and activities with the potential to significantly impact safety of operations. Determine if the USI process establishes a framework to identify modifications to documentation, operations, systems, components, or the addition of new activities that could significantly impact safe operations.

**Criteria:**

The purpose of the USI process is to:

a. Inform and ensure contractor/ DOE management awareness of proposed changes or new findings that could impact the safety of operations.

b. Provide a structured approach for decision making regarding operations following proposed changes or discovery of as-found conditions.

c. Identify possible changes to the safety analysis supporting the FSAD or the ASE that would follow identification of a USI.

**Approach:**

**Record Reviews:** Review Accelerator Operations Directives and Safety Configuration Management Board (SCMB) procedures associated with identifying and evaluating potential USI conditions. Review the process for communicating USI-related information to contractor/DOE management. Review SCMB records regarding previous USI determinations.

**Interviews:** Interview selected staff/management regarding their understanding of the USI process and the mechanisms used to communicate USI-related information.

**Performance Review:** Identify those selected facility activities (e.g. record reviews, walkthroughs, etc.) designed to identify and report potential USI conditions.

**Performance Demonstrations:** Conduct Table-top discussion with SCMB staff related to a recent safety concern or identified USI.

| **Unreviewed Safety Issues** **Lines of Inquiry, Status/Evidence and ARR Notes** |
| --- |
| **LOI** | **Status/Evidence** | **ARR Reviewer Notes** |
| 1. A documented USI process exists and is based on DOE O 420.2C requirements.
 | **Status:** Complete**Evidence:** SCMB Charter<https://wwwold.jlab.org/ehs/scmb.html>* USI Procedure
* Interview those involved in USI process development and management
* Review history and status of USI process as well as lessons learned
* Consider role of USI in relation to safety analysis/FSAD/ASE
 |  |
| 1. Determine if adequate processes exist to identify intended changes or discovered safety issues which may pose unreviewed hazards.
 | **Status:**   **Evidence:** Accelerator Operations Directives <http://opsntsrv.acc.jlab.org/ops_docs/online_document_files/ACC_online_files/accel_ops_directives.pdf> |  |
| 1. Review interface of USI process with facility configuration management program.
 | **Status:**   **Evidence:** Conduct of Engineering Manual<https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-21395/FSAD%20REV%207%20%28110512%29.pdf> * Conduct Table-top discussion with SCMB staff related to a recent safety concern or identified USI
 |  |
| 1. Determine adequacy of USI process to support commissioning.
 | Basis for decision | Signoff |

## C2 Contractor Assurance System (CAS)

**Objective:**

Verify that Jefferson Lab implements an effective CAS program consistent with DOE O 420.2C. Verify that the CAS program effectively combines DOE and laboratory operational and safety oversight activities into a single comprehensive site performance management system that promotes safe and effective operation.

**Criteria:**

Jefferson Lab’s CAS provides a comprehensive internal assessment process to ensure that operational and safety programs to protect workers, public, and the environment are effectively implemented. The accelerator operations and safety programs, particularly the credited controls identified in the ASE, are effectively implemented, managed, and continuously improved.

**Approach:**

**Document Review:** Review operational and safety program plans, approval letters, procedures, assessments, and other related facility documents.

**Staff/Management Interviews:** Interview selected operations, safety, and ESH&Q personnel to assess their management and/or understanding of CAS processes (e.g., procedures, communications, independent verification) in the performance of their duties.

**Performance Review**: Review staff/management performance of selected CAS processes (e.g. procedures, communications, independent verification, etc.) to determine program effectiveness. Observe data in corrective action tracking system.

**Performance Demonstrations:** N/A

| **Contractor Assurance System (CAS)****Lines of Inquiry, Status and Evidence for Each Criterion** |
| --- |
| **LOI** | **Status/Evidence** | **ARR Reviewer Notes** |
| 1. CAS provides a comprehensive internal assessment process.
 | **Status:****Evidence:** Program Description<https://misportal.jlab.org/InsightWebProject/docushareDownload/Approved_CAS_Program_Description.pdf?handleIndex=41240&fileName=Approved_CAS_Program_Description.pdf>FY 2013 Integrated Assessment Schedule <https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-66232/FY13%20Assessment%20Schedule%20091012%20FINAL.pdf>* Interview selected operations and safety staff/ management to assess CAS understanding
* Review previous Jefferson Lab CAS program assessments and outcomes.
 |  |
| 1. CAS Program uses external assessment: employs peer reviews and assessments that include accelerator subject matter experts from other accelerator facilities.
 | **Status:****Evidence:** * ARR, August 2013
* OHSAS18001 registration
 |  |
| 1. CAS Program integrates ASO requirements and includes a periodic assessment of DOE O 420.2C CRD requirements.
 | **Status:****Evidence:** 2010 Accelerator Internal Safety Review<https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-29440/MSA%202010-06.pdf>* Documents reviewed
* Review CATS for findings related to the Accelerator, and review work observations for 12 GeV construction activities. Pick one or two and use them during the walkthrough/visit to the Accelerator to show evidence of tracking and closure of Accelerator-related issues
* Assessment Review Report #14827 OFIs or findings from any recent reviews/audits properly dispositioned?
 |  |
| 1. CAS Program supports the Accelerator Readiness Review process.
 | **Status:****Evidence:** * ARR conducted under the auspices of ESH&Q with QA/CI support
* MOA-2012-136 CATS # MOA 2012-136
* CAS MSA and CRAD/LOIs FY12 Combined.pdf
* ARR Program Description
* Review staff/ management performance of selected CAS activities
 |  |
| 1. Determine CAS adequacy to support commissioning.
 | Basis for decision | Sign off |

## C3 Safety Configuration Management (SCM)

**Objective:**

Verify that there is a Facility Configuration Management Program that is related to accelerator safety. Verify that the configuration management of Credited Controls, system interfaces, and supporting documented processes, procedures, and records are consistent with the DRAFT Accelerator Facility Safety Implementation Guide for DOE O 420.2C, SAFETY OF ACCELERATOR FACILITIES (August 2012)**.**

**Criteria:**

There is a documented configuration management process applied to safety related administrative and engineered Credited Controls, the management of safety-related procedures and training, and management of records. Configuration management is applied on a graded approach to defense-in-depth controls.

**Approach:**

**Record Reviews:** Review installation drawings, test procedures, and commissioning records for Credited Controls. Review records and procedures associated with the maintenance, operations, and function of Credited Controls.

**Interviews:** Interview Jefferson Lab Engineering Division staff and SCMB members regarding the application of configuration management requirements for Credited Controls.

**Performance Demonstrations:** Observed the configuration of Credited Controls and compare as-built to configuration-managed engineering drawings. NOTE: This will also be addressed in Software QA, Operations Training and Qualifications, and ASE equipment inspections.

| **Safety Configuration Management****Lines of Inquiry, Status/Evidence and ARR Notes**  |
| --- |
| **LOI** | **Status/Evidence** | **ARR Reviewer Notes** |
| 1. Systems with safety significance are consistently managed with a graded approach using a well-defined program.
 | **Status:****Evidence:*** Site wide configuration management process applied on a graded approach to personnel safety systems (PSS) and PSS interfaces
 |  |
| 1. Level of configuration management is prioritized to and appropriate to credited controls.
 | **Status:****Evidence:*** Conduct of engineering manual and field practices employ highest level of CM to personnel safety systems (PSS) and PSS interfaces
 |  |
| 1. Design requirements, drawings, actual field configuration remain consistent, documented, and accurate.
 | **Status:****Evidence:*** Observe that work planning and control processes identify PSS interfaces
* System owners with PSS interfaces trained in maintaining CM for credited controls.
 |  |
| 1. The configuration of Credited Controls is properly managed during accelerator operation and maintenance.
 | **Status:****Evidence:** * Conduct of engineering manual change control practices
* Safety Configuration Management Board charter, interviews, and table-top application of USI process
 |  |
| 1. The configuration of administrative processes related to Credited Controls (e.g. training, procedures, records etc.) are properly managed.
 | **Status:****Evidence:*** Conduct of engineering manual required practices for CM on documents and records
 |  |
| 1. Determine adequacy of CM program to support commissioning and routine operations.
 | Basis for decision | Sign off |

## C4 Commissioning Plan (CP)

**Objective:**

Verify that there is a documented Commissioning Plan consistent with the DRAFT Accelerator Facility Safety Implementation Guide for DOE O 420.2C, SAFETY OF ACCELERATOR FACILITIES (August 2012).

**Criteria:**

The Commissioning Plan presents sufficient detail to describe the resources (people, equipment, and procedures), the organization, and the procedures necessary for safe commissioning. The Commissioning Plan must have sufficient internal review and oversight to ensure safe commissioning.

**Approach:**

**Record Reviews:** Review the results of the June 6-7, 2013, Directors Beam Commissioning Plan Review.

**Interviews:** Discuss the Beam Commissioning Plan with Operations Director, Accelerator Operators, Commissioning Advisory Board, and CASA staff, and evaluate their level of integration, how well they understand the commissioning goals and their roles (responsibilities, authorities, etc.). Discuss the disposition of Directors Beam Commissioning Plan Review recommendations.

**Performance Demonstrations:** Evaluate outcomes of pre-Hot Checkout Reviews. Observe Control Room Procedures, Staffing Plans, and Operations and CASA Training activities where possible.

| **Commissioning Plan (CP)****Lines of Inquiry, Status/Evidence and ARR Notes** |
| --- |
| **LOI** | **Status/Evidence** | **ARR Reviewer Notes** |
| 1. Commissioning Plan fully describes roles, responsibilities, accountabilities, and authorities that establish the expectations and duties of managers, supervisors, and operators for carrying out the commissioning/operations and any related documented authorizations.
 | **Status:****Evidence:** |  |
| 1. Commissioning Plan addresses staffing schedules, authority and reporting chain for operational, safety, and scheduling issues procedures (normal and emergency/contingency), administrative controls, and personnel training (including records and qualification for commissioning at the stated intensity).
 | **Status:****Evidence:** |  |
| 1. Commissioning Plan identifies or properly references engineered safety systems that will be operable for the accelerator.
 | **Status:****Evidence:** |  |
| 1. Commissioning Plan identifies the operational characteristics for specific modes of commissioning needed to support the safety case for progressively higher power commissioning.
 | **Status:****Evidence:** |  |
| 1. Lessons learned from previous shut-down periods are incorporated to improve procedures and identify additional procedures that are needed.
 | **Status:****Evidence:** |  |
| 1. Evaluate Commission Plan progress to date.
 | **Status:****Evidence:*** Select one pre-Hot Checkout Review and follow check group progress with respect to dashboard
 |  |
| 1. Determine adequacy of training program to support commissioning.
 | Basis for decision | Sign off |

#

## C5 Accelerator Readiness Review (ARR) Process and Plan

**Objective:**

Determine that Jefferson Lab, in accordance with the Accelerator Readiness Review (ARR) program, has completed an internal readiness plan in preparation for the ARR. Determine that the Jefferson Lab ARR program and its associated plan provides an effective approach for verifying that hardware, personnel, and administrative systems/programs are ready. Determine that successful completion of the ARR provides adequate basis for DOE approval of operations.

**Criteria:**

The ARR process should include:

1. A readiness plan identifying those elements of accelerator operations ready for verification by the ARR Team, expected milestones to be achieved, and the process for assuring safe operation;
2. A verification process to ensure accelerator hardware, personnel, and administrative systems/programs are in place and adequate to support safely the full scope of activities proposed for commissioning;
3. An ARR scope that reflects the size, complexity, and hazards associated with the accelerator facility;
4. Verification of compliance with the safety program elements of the CRD for 420.2C and the ASE;
5. Documentation reviews, inspections, management/staff interviews, and attendance at specific operations/ training as appropriate; and
6. A report that adequately documents team activities, review scope, review criteria, review results, and a recommendation on whether the ARR supports approval for operations.

**Approach:**

**Document Review:** Review the status of the Jefferson Lab ARR Plan. Review the Jefferson Lab ARR plan, scope and schedule, and CRADs/LOIs to determine adequacy of hardware, personnel, and administrative systems/program readiness review. Review the Jefferson Lab ARR Plan to ensure that it addresses (directly, or by proper reference):

1. Roles, responsibilities, accountabilities, and authorities that establish the expectations and duties of managers, supervisors, and operators for carrying out the commissioning;
2. Procedures, personnel training and qualification, and other administrative controls for commissioning at the stated intensity;
3. Engineered safety systems that will be operable for the accelerator and accelerator-associated experimental facilities; and
4. Specific facilities, sub-systems, and modes of commissioning to be exercised.

**Staff/Management Interviews:** Interview Jefferson Lab management and Jefferson Lab internal review team members on the Jefferson Lab internal readiness review. Interview management/staff on the scope of ARR preparations. Ensure that the following elements incorporated or referenced in the ARR Plan are effectively understood and implemented at the appropriate organizational level:

1. Reporting chain to whom problems encountered are reported (e.g., operational, safety, scheduling problems);
2. Responsible party who makes the necessary notifications or arrangements for authorizations;
3. Authorizations and training records to be audited; and
4. Number and types of qualified personnel required for commissioning activities.

**Performance Review**: Perform selected inspections/walkthroughs identified in the ARR Plan to verify that hardware and administrative processes are ready for the appropriate commissioning or operational phase. Engage selected management/staff in interviews/discussions to verify readiness to conduct activities for the appropriate commissioning or operational phase.

**Performance Demonstrations:** View work evolution involving Control Room and on-call support or maintenance staff for the October ARR.

| **Accelerator Readiness Review (ARR) Process** **Lines of Inquiry, Status/Evidence and ARR Notes** |
| --- |
| **LOI ARR Process** | **Status/Evidence** | **ARR Reviewer Notes** |
| 1. The ARR Plan is an integral part of the Contractor Assurance System
 |  |  |
| 1. The Accelerator Readiness Review process includes an ARR plan that identifies those elements of accelerator operations ready for verification by the ARR Team.
 | * [Accelerator Readiness Review Program](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-34690)
* CRAD/LOI identified in ARR Plan
* Appendices
 |  |
| 1. The ARR process provides for verification that accelerator hardware, personnel, and administrative systems/programs are in place and adequate to support safely the full scope of activities proposed for commissioning.
 | * [Accelerator Readiness Review Program](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-34690)
* CRAD/LOI identified in ARR Plan
* Appendices
 |  |
| 1. The ARR scope reflects the size, complexity, and hazards associated with the accelerator facility.
 | * CRAD/LOI identified in ARR Plan
* Appendices
 |  |
| 1. The ARR provides for verification of compliance with the safety program elements of the CRD for 420.2C and the ASE.
 | * CRAD/LOI identified in ARR Plan
* Appendices
 |  |
| 1. The ARR provides for the review of documentation, inspections, management/staff interviews, and attendance at specific operations/ training as appropriate.
 | * CRAD/LOI identified in ARR Plan
* Appendices
 |  |
| 1. The ARR process provides for a report that adequately documents team activities, review scope, review criteria, review results, and a recommendation on whether the ARR supports approval for operations.
 | * [Accelerator Readiness Review Program](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-34690)
 |  |
| 1. ARR Process verifies readiness to commission.
 | Basis for decision | Sign off |

## C6 Work Planning and Control

**Objective:**

Determine that Jefferson Lab has an effective work controls program consistent with both DOE and contractor requirements. Determine that Jefferson Lab work controls are managed as part of a controlled system complete with processes for regular update and revision. Determine that work controls, updates, and revisions are effectively communicated as part of the Jefferson Lab configuration management program.

**Criteria:**

The Jefferson Lab work control program should include:

1. Approved work plans for proposed work, particularly those systems with safety significance;
2. Review of proposed work and approval/authorization before starting;
3. Work assignments only for qualified and authorized personnel;
4. Management validation of work for completeness and functionality;
5. Document control of the program and any updates/revisions as necessary; and
6. Effective communication of information on controlled work scope.

**Approach:**

**Document Review:** Review Jefferson Lab work control program documentation. Review selected work control procedures on those accelerator systems associated with engineered controls.

**Staff/Management Interviews:** Interview Jefferson Lab management/staff with responsibility for the work control program. Interview selected Jefferson Lab operations and maintenance staff on their experience with the Jefferson Lab work control program.

**Performance Review**: Assess process for communicating work status and any modifications to work controls. Review work processes to determine if work was properly completed and whether lessons learned were developed.

**Performance Demonstrations:** Attend selected operations/maintenance activities performed under specific work controls. Interview operations/maintenance staff regarding the process to update or revise procedures if work scope changes.

| **Work Planning and Control****Lines of Inquiry, Status/Evidence and ARR Notes** |
| --- |
| **LOI** | **Status/Evidence** | **ARR Reviewer Notes** |
| 1. Work planning approach employs ISM: Integrates safety into work planning.
 | **Status:****Evidence:*** Review program to develop, manage, update, and revise Jefferson Lab work controls
* Review Jefferson Lab work control program documentation
 |  |
| 1. Work planning includes graded approach to hazard controls and work approval/authorization based on the hazard.
 | **Status:****Evidence:*** Review work planning and integration tools
* Review applicable portions of ESH Manual
 |  |
| 1. Work hazards are effectively identified.
 | **Status:****Evidence:*** Observe work practices and compare with work planning and control documents
 |  |
| 1. Work hazards are effectively mitigated.
 | **Status:****Evidence:** * Observe radiological work planning for ALARA
* Use of hierarchy of controls
* Implementation of ALARA
 |  |
| 1. Training is an integral part of work hazard mitigation.
 | **Status:****Evidence:*** Review selected training records
 |  |
| 1. Proposed work on safety systems is properly evaluated and pre-approved.
 | **Status:****Evidence:** * Review selected qualifications and authorizations
 |  |
| 1. Management verifies work for quality, completeness, functionality, etc.
 | **Status:****Evidence:*** Interview selected management/staff on their role in the work control program
 |  |
| 1. Work documents are controlled, updated/revised as necessary.
 | **Status:****Evidence:*** Review selected safety procedures
 |  |
| 1. There is effective communication, especially for scope changes.
 | **Status:****Evidence**:* Discuss work control program with selected management and workers regarding communicating changes in work controls
 |  |
| 1. Work controls program supports commissioning and operations.
 | Basis for decision  | Sign off |

## C7 Lessons Learned Program

**Objective:**

Determine that Jefferson Lab has an effective program to identify Jefferson Lab routine or non-routine occurrences that would serve as a valuable lessons learned internally or to other DOE and non-DOE organizations. Determine that Jefferson Lab implements an effective program to access and utilize relevant lessons learned from other DOE facilities and non-DOE industrial or academic organizations. Determine that Jefferson Lab has a systematic program to disseminate lessons learned within Jefferson Lab and communicate to other DOE laboratories as warranted.

**Criteria:**

An effective lessons learned program is comprised of the following elements:

1. A coordinated site-wide program to identify those routine and non-routine Jefferson Lab occurrences that elevate to the level of a valuable lessons learned for the Jefferson Lab site as well as other DOE facilities;
2. A systematic process to access lessons learned at other DOE and non-DOE facilities that of value for Jefferson Lab; and
3. A program to effectively disseminate Jefferson Lab lessons learned and lessons learned from other sites to those Jefferson Lab management/staff best suited to utilize the information.

**Approach:**

**Document Review:** Review Jefferson Lab lessons learned program documentation and procedures. Review selected examples of lessons learned previously disseminated to Jefferson Lab management/staff. Review Jefferson Lab actions taken in response to selected lessons learned.

**Staff/Management Interviews:** Interview Jefferson Lab lessons learned coordinator and selected management on their role in the Jefferson Lab lessons learned program. Interview selected staff regarding their access to and benefits from the lessons learned program.

**Performance Review**: Participate in a discussion with selected management/staff to address the effectiveness of the Jefferson Lab lessons learned program and the criteria for identification of valuable lessons learned.

**Performance Demonstrations**: N/A

| **Lessons Learned Program****Lines of Inquiry, Status/Evidence and ARR Notes** |
| --- |
| **LOI** | **Status/Evidence** | **ARR Reviewer Notes** |
| 1. Review Jefferson Lab lessons learned program procedures and documents to verify coordinated site-wide program.
 | * Review program procedures
* Review criteria for identifying lessons learned
* Review lessons learned documents/records
 |  |
| 1. Verify that the program identifies routine and non-routine Jefferson Lab occurrences that elevate to the level of lessons learned.
 | * Review selected lessons learned recently evaluated and distributed
 |  |
| 1. Verify that the program identifies and evaluates lessons learned at other DOE and non-DOE facilities.
 | * Interview Jefferson Lab lessons learned coordinator
* Discuss role in the Jefferson Lab lessons learned program
 |  |
| 1. Verify that there is a Jefferson Lab program to effectively disseminate lessons learned to those best suited to use the information.
 | * Interviews with selected Jefferson Lab management/ staff/subject matter experts regarding their systems
 |  |
| 1. Verify that recent external accelerator-based lessons learned have been effectively evaluated and incorporated into current Accelerator Readiness Review.
 | * Interviews with selected Jefferson Lab management/ staff/subject matter experts regarding their systems
* Review effectiveness of lessons learned program based on materials presented
 |  |
| 1. Lessons learned processes effectively support commissioning and operations.
 | Basis for decision | Sign off |

## C8 Software QA

**Objective:**

Verify that accelerator and safety system software used to control the accelerator is developed according to standards and protocols that provide adequate protection from conditions that could exceed requirements in the Accelerator Safety Envelope.

**Criteria:**

There is a documented program and associated processes that provide suitable quality assurance for computer software programs used to control accelerator functions. The quality assurance processes should be based on current industry best practices. Quality assurance processes should provide protection from software based errors that can result in a failure of accelerator protection systems or processes.

**Approach:**

**Record Reviews:** Review software design processes, post installation software performance data (e.g. error logs), requests for software maintenance, etc. Review risk-based software grading process and documentation commensurate with grading level and procedures applied.

**Interviews:** Interview Jefferson Lab Computer Engineering and Safety Systems Group staff regarding the effectiveness of quality assurance processes in the design and use of accelerator and safety system controls software. Interview software end users.

**Performance Demonstrations:** Observed installed software function for safety related applications, evidence of real-time function, and evidence of performance such as automated logging.

| **Software QA****Lines of Inquiry, Status/Evidence and ARR Notes** |
| --- |
| **LOI** | **Status/Evidence** | **ARR Reviewer Notes** |
| 1. The development of accelerator controls and safety system software is governed by applicable standards.
 | **Status:** **Evidence:**  |  |
| 1. The applicable standards require, at a minimum:
	1. written requirements or specifications
	2. software version management
	3. documentation
 | **Status:****Evidence:** |  |
| 1. Accelerator controls and safety system software have accurate configuration information from users/system owners for device control and data translation.
 | **Status:****Evidence:** |  |
| 1. There are resources that allow controls and safety system software to be tested before implementation.
 | **Status:****Evidence:** |  |
| 1. The interface for programmers needing information or analysis data is controlled.
 | **Status:****Evidence:** |  |
| 1. Software users are adequately trained and authorized depending on the level of control afforded by accelerator and/or safety system software before being allowed access.
 | **Status:****Evidence:** |  |
| 1. There is an adequate user feedback mechanism to resolve software issues.
 | **Status:****Evidence:** |  |
| 1. Accelerator controls and safety system software are configuration managed.
 | **Status:****Evidence:** |  |
| 1. There are adequate personnel resources to maintain the accelerator controls and safety system software applications. Personnel are trained and authorized.
 | **Status:****Evidence:** |  |
| 1. There are adequate fiscal resources to maintain accelerator controls and safety system software applications.
 | **Status:****Evidence:** |  |
| 1. There is adequate infrastructure to maintain and support accelerator controls and safety system software applications.
 | **Status:****Evidence:** |  |
| 1. Software QA supports activities related to accelerator commissioning and operation
 | Basis for decision | Sign off |

## C9 Cyber Security

**Objective:**

Verify adequate protection of the confidentiality, integrity, and availability of data processed in accelerator control systems and safety systems. Verify that these systems are identified and adequately mitigated from the standpoint of risks with the potential to create conditions exceeding the accelerator safety envelope.

**Criteria:**

There is a documented cyber-security program and associated processes and equipment that provide a suitable graded risk management approach to mitigate risks for data processed by system hardware and software used to control accelerator functions. The cyber-security program, processes, and equipment should be based on current NIST and DOE recommended standards and practices, as well as accepted good practice at other DOE Office of Science accelerator facilities. The cyber-security program and its processes and equipment should protect against unintended actions by laboratory users and staff as well as intentional tampering by internal and external actors. The cyber security program should also include continuously monitoring and forensic functions to identify and react to potential cyber intrusions.

**Approach:**

**Record Reviews:** Review plans, equipment specifications, installation and test procedures and results, internal controls, and performance data.

**Interviews:** Interview Jefferson Lab staff regarding the operation and maintenance of cyber-security equipment and processes.

**Performance Demonstrations:** Observe installed equipment, evidence of real-time function, and evidence of performance such as automated logging of hardware self-checks and faults or security challenges.

| **Cyber Security****Lines of Inquiry, Status/Evidence and ARR Notes** |
| --- |
| **LOI** | **Status/Evidence** | **ARR Reviewer Notes** |
| 1. There is a plan that addresses cyber security on a site-wide basis and specifically for accelerator controls.
 | **Status:** Complete**Evidence:** <https://cc.jlab.org/cert10/pdf/site-cspp.pdf><https://cc.jlab.org/cert10/pdf/ac-secplan.pdf> |  |
| 1. The cyber security risk assessment for accelerator controls adequately identifies threats and vulnerabilities specific to the operating environment.
 | **Status:****Evidence:*** Cyber Security Risk Assessment
* Documentation
 |  |
| 1. The cyber-risk assessment for accelerator controls adequately identified risks and counter measures to reduce risks to an acceptance level.
 | **Status:****Evidence:*** Cyber Security Risk Assessment
* Documentation
 |  |
| 1. There is an authority to operate the system used to control accelerator functions within acceptance risks.
 | **Status:****Evidence:*** System Security Test and Evaluation plan
* An Authority- to-Operate the system memo issued from the TJSO Authoring Official
 |  |
| 1. The cyber-security plan incorporates the following recommended practices and protocols:
	1. defense-in-depth by layering
	2. physical security
	3. network segmentation and isolation
	4. Internal/ external fire-walling
	5. mitigation of insecure processes and protocols
	6. access control from on and off-site
	7. authentication management
	8. user auditing
	9. configuration management including patches
	10. monitoring and use analysis
	11. vulnerability scanning and periodic
	12. Incident Response/Contingency Planning
	13. Control of external media devices
	14. Remote access
 | **Status:****Evidence:*** System Security Plan
 |  |
| 1. There are adequate personnel resources to maintain the cyber-security program and processes:
	1. personnel are trained and authorized
 | **Status:****Evidence:*** Site CSPP Roles and Responsibilities
* Information Security Site Manager
* Information System Security Officer
* System Administrator
* Incident response personnel
 |  |
| 1. There are adequate fiscal resources to maintain the cyber-security program equipment through near-term software and hardware upgrades
 | **Status:****Evidence:*** Exhibit 53 or 300 or similar management and investment information for system hardware and software used to control accelerator functions.
 |  |
| 1. There is adequate infrastructure to maintain and support cyber-security for accelerator controls.
 | **Status:****Evidence:*** Cyber System Security plan
* Internal Network Segmentation
* Network Perimeter Protection
 |  |
| 1. Software QA supports activities related to accelerator commissioning and operation.
 | Basis for decision  | Sign off |

## C10 Operations Training and Qualification Program

**Objective:**

Verify that Jefferson Lab has developed and is implementing an effective accelerator operations training program consistent with DOE O 420.2C requirements.

**Criteria:**

DOE O 420.2C requirement (in a.) and guidance suggests that the site training program provide:

1. Clearly defined roles and responsibilities for accelerator activities;
2. A description of the overall operations training program and its relationship to the lab-wide training process;
3. Training for operators that includes the training normally provided for individuals who work in and around the accelerator facility based on site safety programs, site hazards, and emergency procedures;
4. Training for operators includes specific training and qualification for beam control and delivery, as well as systems that control access to the accelerator enclosure (credited controls);
5. Training for operators includes specific training and qualification for activities shared by operators that support maintenance and diagnostic duties (to include job-specific procedures and controls); and
6. Ongoing monitoring of personnel training program to assess overall effectiveness and support continuous improvement.

**Approach:**

**Document Review:** Review selected training procedures related to the Jefferson Lab site-wide program. Review selected personnel training and qualification documentation to assess program effectiveness.

**Staff/Management Interviews:** Interview the Jefferson Lab training manager on features of the Jefferson Lab training program. Interview selected administrative and technical personnel regarding their experience with the training and qualification program.

**Performance Review**: Review selected training modules provided for administrative, operations or experimental staff. Interview selected personnel during training-specific job assignments to assess training effectiveness.

**Performance Demonstrations:** Observe training event or training verification event in so far as possible. Otherwise, engage in panel discussion on the plans for bringing operations staff back from the field and retraining/requalification.

| **Operations Training and Qualifications Program****Lines of Inquiry, Status/Evidence and ARR Notes** |
| --- |
| **LOI** | **Status/Evidence** | **ARR Reviewer Notes** |
| 1. There is a documented training and qualification process designed to ensure operator competence for operations personnel.
 | * Review Jefferson Lab site training program documentation and procedures
* Interview Jefferson Lab Training and Performance Manager or associated staff regarding program
* Review Operator Training program
 |  |
| 1. Operator training and qualification process includes clearly defined roles and responsibilities for accelerator operational activities.
 | * Review Operator Training program
 |  |
| 1. Operator training and qualification process considers applicable physics and engineering principles.
 | * Review Operator Training program
 |  |
| 1. Operator training and qualification process includes specific training and qualification for beam control as well as systems that control access to the accelerator enclosure (credited controls).
 | * Review training approach with respect to individual responsibilities regarding SAD, ASE, and USI
 |  |
| 1. Operator training addresses normal and abnormal condition and emphasizes development of diagnostic skills for early recognition of abnormal conditions.
 | * Review Operator Training program for applicable emergency procedures

Interview selected Jefferson Lab personnel regarding training |  |
| 1. Operator training includes training that is normally provided for individuals who work in and around the accelerator, such as ODH, RadCon, etc.
 | * Review use of facility or hazard specific training modules
* Attend/review selected training modules
* Interview selected Jefferson Lab personnel regarding training
* Observe selected job assignments and compare with job-specific training
 |  |
| 1. Training program incorporates periodic testing and performance checks, and re-qualification requirements.
 | * Review Operator Training program documentation
* Interview selected Jefferson Lab operations personnel regarding training
 |  |
| 1. Operator training, documentation includes auditable records of training received.
 | * Interview selected Jefferson Lab operations personnel regarding training
* Observe Operator Training records
 |  |
| 1. Determine adequacy of training program to support commissioning.
 | Basis for decision | Sign off |

## C11 Operations Procedures

**Objective:**

Determine that Jefferson Lab has an effective operational procedures program consistent with DOE and contractor requirements. Determine that the Jefferson Lab operational procedures program addresses the accelerator operations with safety significance. Determine that Jefferson Lab procedures are controlled complete with processes for regular updates and revisions. Determine that procedural updates and revisions are effectively communicated consistent with the Jefferson Lab configuration management program.

**Criteria:**

The operational procedures program for operations of safety significance should:

1. Provide specific directions to ensure safe operations during routine, non-routine and emergency situations;
2. Provide sufficient detail commensurate with the level of hazard and complexity of operation;
3. Reflect available operational experience written in a format readily usable to operational staff;
4. Incorporate lessons learned from past operations in order to improve the procedure and identify potential need for other procedures; and
5. Be controlled documents with specific attention to those procedures that reflect ASE requirements.

**Approach:**

**Document Review:** Review Jefferson Lab procedures program documentation. Review selected operational procedures with safety significance.

**Staff/Management Interviews:** Interview Jefferson Lab procedure manager(s) on procedures program. Interview selected Jefferson Lab management/staff on their use of specific procedures and the mechanisms to contribute to the program.

**Performance Review**: Attend selected operations/maintenance activities performed under specific operational procedures. Interview the operations/maintenance staff regarding their opportunity to modify, update or revise procedures.

**Performance Demonstrations:** N/A

| **Operations Procedures****Lines of Inquiry, Status/Evidence and ARR Notes** |
| --- |
| **LOI** | **Status/Evidence** | **ARR Reviewer Notes** |
| 1. Review Jefferson Lab procedure program documentation.
 | **Status:****Evidence:*** Review process to develop, document, control, update, and revise Jefferson Lab operational procedures.
 |  |
| 1. Interview Jefferson Lab procedure manager(s) regarding program.
 | **Status:****Evidence:*** Discuss with process of ensuring that procedure creation, updates and revisions are effectively communicated
* Discuss process for procedures management supporting ASE requirements
 |  |
| 1. Interview selected management/staff on their role in the Jefferson Lab operational procedure program.
 | **Status:****Evidence:*** Discuss with process of ensuring that procedure creation, updates and revisions are effectively communicated
* Discuss with staff process of identifying new procedures and ability to provide feedback on those procedures
 |  |
| 1. Observe selected job assignments with job-specific procedures.
 | **Status:****Evidence:*** Observe operator execution of PSS certification procedure
* Discuss use and adequacy of the specific procedure(s) as well as mechanisms to provide feedback on the procedure content, any updates, or procedure revisions
 |  |
| 1. Determine adequacy of procedure program to support commissioning.
 | Basis for decision | Sign off |

## C12 Industrial System Safety (ISS)

**Objective:**

Jefferson Lab uses industrial (electrical/mechanical) systems to support accelerator operations. These systems present hazards. Determine that the process for managing hazards, addresses the full range of hazards associated with the system, from the initial stages of design/modification through installation and operational checkout. Determine that the industrial hazards are effectively integrated into accelerator work planning and control processes. Determine that the Jefferson Lab ISS incorporate lessons learned from previous accelerator operations or external events.

**Criteria:**

Systems with industrial safety considerations are:

1. Designed with industrial hazard mitigations in place where possible;
2. Documented such that systems, their interfaces and dependencies, are well understood;
3. Well understood and controlled using best industry practices and lessons learned;
4. Effectively integrated with laboratory work planning and control program; and
5. Effectively integrated with accelerator operations

**Approach:**

**Document Review:** Review design specifications, if applicable. Review system documentation. Observe operational safety procedures, bench-top procedures, etc. to verify industrial hazards from routine and non-routine (trouble-shooting, maintenance, repair) operations are properly addressed. Determine if system documentation, associated training, provides an effective operations interface.

**Staff/Management Interviews:** Interview subject matter experts on their participation in the repair, maintenance, or upgrade to their systems. Discuss the industrial hazards associated with their systems and how those hazards are mitigated with; focus on changes that meet the hazards associated with accelerator commissioning or operations following the 12 GeV upgrade.

**Performance Review**: Perform facility/building walkthrough and inspection activity on selected equipment with focus on upgraded or new systems/equipment. Performance options include observing selected work activities such as system installation, ongoing maintenance and repair, or observing system operation. Conduct workplace discussion with staff regarding changes to or additional hazards associated with system upgrades.

**Performance Demonstrations:** Observing on-going work on the system or observe field activity to properly “safe” the system before repair/inspection.

| **Industrial System Safety (ISS)****Lines of Inquiry, Status/Evidence and ARR Notes** |
| --- |
| **LOI** | **Status/Evidence** | **ARR Reviewer Notes** |
| 1. Are the industrial hazards of the system well understood?
 | * Operational Safety Procedures, electronic task list entries for system
 |  |
| 1. Were the hazards of the system considered during the design phase?
 | * Discuss design efforts to develop systems that interfaces with existing controls
* System design and procurement specifications
 |  |
| 1. Does the system design, where possible, use engineered safeguards to minimize industrial hazards during operation?
 | * Design efforts
* Design documents
* Observed system features
 |  |
| 1. Is the system design documented?
 | * Observe design, fabrication, or related documents
 |  |
| 1. Does the system interface to other industrial systems and is that interface documented?
 | * Observe documentation
* Discussion with subject matter expert
* Observed system features
 |  |
| 1. Does the system interface to the PSS?
 |  |  |
| 1. Are the documents available to staff that work on the system?
 | * Documentation available in the field
* Discussion with maintenance, repair, and operation staff
 |  |
| 1. Was the system checked to ensure it performed according to design when it arrived at the lab (or at the point of assembly)?
 | * Observe receipt inspection and/or test results, if applicable
 |  |
| 1. Are there further operational checks needed before it is placed in service?
 | * System operational checks, checklists, and signoff
 |  |
| 1. Are there system integration checks needed before the systems is placed in service?
 | * System operational checks, checklists, and signoff
* Demonstration of system operation
 |  |
| 1. Are the hazards of working on (installing, trouble-shooting, repairing, maintaining) the installed system mitigated on the basis of a laboratory industrial safety program?
 | * Operational Safety Procedures and electronic task list entries for system repairs
 |  |
| 1. Are the hazards of working on the system mitigated as part of an integrated laboratory work planning and control process?
 | * Review work planning and integration tools
* Review applicable portions of ESH Manual
* Observe work practices and compare with work planning and control documents
 |  |
| 1. Is the staff that works on the system qualified and are they authorized to conduct work on the system?
 | * Review qualifications and authorizations
 |  |
| 1. Is the system incorporated into the Hot Checkout Process?
 | * Review Hot Checkout System documentation
 |  |
| 1. Are there lessons learned from previous operational experience with this system? Have they been implemented?
 | * Discussions with subject matter experts regarding lessons learned from previous operations and applications to 12 GeV commissioning and operations
 |  |
| 1. Are industrial systems ready to support commissioning?
 | Basis for decision | Sign off |

## C13 Radiological Protection

**Objective:**

Determine that Jefferson Lab Radiological Protection Plan (RPP) is formally defined and supports accelerator operations during both routine and non-routine operations. Determine that Jefferson Lab radiological protection program addresses the full range of radiological hazards associated with Jefferson Lab operations. Determine that Jefferson Lab radiological protection program incorporates lessons learned from previous accelerator operations. Determine that Jefferson Lab radiological protection program is effectively integrated into accelerator work planning and control. NOTE: RPP changes to support 12 GeV commissioning and operations are included in an additional CRAD/LOI document.

**Criteria:**

The Jefferson Lab radiological protection program:

1. Is based on a DOE approved program plan the meets applicable federal statutes;
2. Is formally defined, controlled, and fully implemented laboratory program;
3. Adequately reflects scope of accelerator radiological hazards for prompt ionizing radiation and activated materials;
4. Is effectively integrated with accelerator operations and other safety and health disciplines;
5. Is effectively integrated as part of the laboratory work planning and control process; and
6. Is effective in maintaining radiological exposures to personnel are maintained as low as reasonably achievable (ALARA).

**Approach:**

**Document Review:** Review the Jefferson Lab Radiological Program (RP) to verify that it is in compliance with DOE radiological protection requirements. Review Jefferson Lab documentation to verify that the RP addresses the range of radiological hazards from routine and non-routine operations including credible accident scenarios. Determine if program documentation (procedures, permits, etc.) provides an effective interface with other safety and health disciplines and supports accelerator operations.

**Staff/Management Interviews:** Interview the RP Manager on effectiveness of the current program and the changes in the program to meet anticipated radiological protections. Interview selected management/staff on their interface with the radiological protection program with emphasis on effective communication and program implementation during the upgrade activities.

**Performance Review**: Perform selected facility/building walk-through and inspections. Participate in a table top discussion to review radiological protection practices to address hazards associated with facility upgrade activities.

**Performance Demonstrations:** Observe selected work activities such as radiological surveys, monitoring, sampling, job coverage, and radiological support functions as available. Review an activity associated with the performance of Assigned Radiation Monitor (ARM) duties of Accelerator Operations personnel.

| **General Radiological Program****Lines of Inquiry, Status/Evidence and ARR Notes** |
| --- |
| **LOI** | **Status/Evidence** | **ARR Reviewer Notes** |
| 1. Is Jefferson Lab RP based on a DOE approved program plan the meets applicable federal statutes?
 | * Jefferson Lab RPP
 |  |
| 1. Is Jefferson Lab RPP a formally defined, controlled, and fully implemented laboratory program?
 | * Jefferson Lab RPP Supplement to ES&H Manual
* Jefferson Lab RP procedures
* Jefferson Lab RP work authorizations including radiological work permits (RWP)
* Jefferson Lab accelerator enclosure entry control requirements
 |  |
| 1. Does Jefferson Lab RPP reflect scope of accelerator radiological hazards for prompt ionizing radiation and activated materials?
 | * Jefferson Lab RPP
* Jefferson Lab RPP Supplement to ES&H Manual
* Jefferson Lab RP procedures
* Jefferson Lab RP work authorizations
* Interviews with RP Manager to discuss evolution of program to meet operational needs
 |  |
| 1. Does the Jefferson Lab RPP utilize lessons learned from internal and external events?
 | * Discussions with RP Manager on incorporation of lessons learned from previous operations and application to future operations
 |  |
| 1. Is a hierarchy of controls effectively implemented including engineering and administrative controls?
 | * Jefferson Lab RPP Supplement to ES&H Manual
* Jefferson Lab RP procedures
* Jefferson Lab RP work authorizations
* Discussions with RP staff, Accelerator operations and Engineering support staff
 |  |
| 1. Is Jefferson Lab RPP effectively integrated with accelerator operations and other safety and health disciplines?
 | * Accelerator Operations Directives
* Discussions with RP staff, Accelerator operations staff
* Discussions with ESH&Q Program Manager
 |  |
| 1. Is Jefferson Lab RPP effectively integrated as part of the laboratory work planning and control process?
 | * Review ATLis and other Task List work planning and integration tools
* Review applicable portions of ESH Manual
* Observe work practices and compare with work planning and control documents for affected task
 |  |
| 1. Is Jefferson Lab RPP effective in maintaining radiological exposures to personnel are maintained as low as reasonably achievable (ALARA)?
 | * Review procedures for dose investigations
* Review annual dosimetry reports
* Perform selected facility walkthroughs/inspections and observe selected work activities
 |  |
| 1. Is the Jefferson Lab RP providing adequate support to upgrade activities?
 | * Discuss changes to radiological conditions associated with upgrade to facility with RP Manager and selected radiological protection personnel
* Query internal stakeholders
 |  |
| 1. Determine adequacy of radiation protection program to support commissioning.
 | Basis for decision | Sign off |

##

## C14 Radiological Protection for Commissioning and Operation

**Objective:**

Determine that Jefferson Lab Radiological Protection Program has fully evaluated and addressed the impact of accelerator commissioning and operations at 12 GeV in the upgraded accelerator facility.

**Criteria:**

The Jefferson Lab radiological protection program resources:

1. Evaluated the (calculated/modeled) relevant radiation source terms for the upgraded accelerator energy and facility;
2. Evaluated operational and environmental impact associated with the upgraded accelerator energy and facility modifications;
3. Identified and incorporated or facilitated necessary changes in structures, infrastructure, processes, and procedures to reflect upgraded accelerator energy;
4. Modified RP programs and processes to reflect upgraded accelerator energy and facility;
5. Identified and planned necessary tests, measurements, and activities to verify calculated and modeled radiation source terms and installed shielding effectiveness; and
6. Worked with operations to effectively integrate RP programs, processes, and tests associated with commissioning and operating upgraded accelerator facility.

**Approach:**

**Document Review:** Review Jefferson Lab documents that serve as the evaluation for and technical basis for 12 GeV Operations. Review Radiological Protection Program (RPP) procedures and processes that address 12 GeV operations.

**Staff/Management Interviews:**

Interview the RPP Manager and selected staff regarding evaluation of operational and environmental impact for 12 GeV commissioning and operations. Interview selected accelerator operations management/staff on their RPP staff interface with emphasis on effective communication of pending changes associated with upgrade activities.

**Performance Review**: Participate in table top discussions with RPP staff and Operations staff to review changes to radiological protection practices associated with facility upgrade activities.

**Performance Demonstrations:** Conduct selected facility/building walk-throughs and observe implementation of RPP generated changes to facilities. Review an activity associated with the performance of Assigned Radiation Monitor (ARM) duties of Accelerator Operations personnel related to the 12 GeV Upgrade.

| **Radiological Protection for 12 GeV Commissioning and Operation** **Lines of Inquiry, Status/Evidence and ARR Notes** |
| --- |
| **LOI** | **Status/Evidence** | **ARR Reviewer Notes** |
| 1. Have the relevant radiation source terms for the upgraded accelerator energy and facility been fully evaluated?
 | * Jefferson Lab Final SAD, ASE
* Technical Basis for Shielding Design
 |  |
| 1. Have the operational and environmental impacts associated with the upgrade been evaluated?
 | * Technical Basis for Shielding Design
* Interviews of 12 GeV Upgrade with Safety Manager and others
 |  |
| 1. Have the facility modifications and program changes necessary to commission been effectively communicated and implemented?
 | * Technical Basis for Shielding Design
* Technical Notes on C100 Cryomodule
* Interviews of 12 GeV Upgrade with Safety Manager, others
 |  |
| 1. Is there a plan to test assumptions regarding source term and effectiveness of shielding?
 | * Interviews with RP Manager and staff
* DRAFT Tests Plans and RPP Procedures
 |  |
| 1. Are the necessary program changes effectively integrated into commissioning and operations?
 | * Interviews with RP Manager and Accelerator Operation Manager to discuss evolution of program to meet operational needs
* Observation of ARM duties associated with upgraded facility changes
 |  |
| 1. Determine adequacy of radiation protection program to support commissioning.
 | Basis for decision | Sign off |

## C15 Emergency Management Program

**Objective:**

Determine that Jefferson Lab has an effective emergency management program that supports accelerator operations during both routine and non-routine operations. Determine that the emergency management program addresses the full range of hazards and personnel risks associated with Jefferson Lab operations. Determine that the Jefferson Lab emergency management program effectively addresses the types of occurrences derived from historical records. Determine that the emergency response program effectively utilizes mutual aid relationships.

**Criteria:**

The Jefferson Lab emergency management program should:

1. Include a technical basis document and an emergency management program plan;
2. Identify hazards and associated onsite and offsite impacts to workers, the public, and the environment from the facility for both normal operations and credible accidents;
3. Benefit from programmatic lessons learned; and
4. Effectively utilize mutual aid relationships.

**Approach:**

**Document Review:** Review the Jefferson Lab Technical Basis Document for Emergency Planning and Emergency Management Plan to determine if the planning documents incorporate identified FSAD hazards, credible accident scenarios, mutual aid relationships, and emergency management lessons learned. Review Jefferson Lab selected emergency response procedures. Review selected emergency response documentation on post-event analysis and programmatic lessons learned.

**Staff/Management Interviews:** Interview the Jefferson Lab Emergency Management manager on the evolution of the Jefferson Lab Emergency Management program. Interview selected management/staff regarding their understanding of the Jefferson Lab Emergency Management program.

**Performance Review**: Participate in a table top discussion to review Jefferson Lab emergency management capabilities for selected types of occurrences. Visit the Tornado Shelter below the North Access Building with special attention to penetrations in the room to mitigate ODH hazard.

**Performance Demonstrations:** Tornado warning siren test and voice notification systems.

| **Emergency Management Program****Lines of Inquiry, Status/Evidence and ARR Notes** |
| --- |
| **LOI** | **Status/Evidence** | **ARR Reviewer Notes** |
| 1. Site has an emergency management program (EMP) supported by documentation and procedures.
 | * Emergency Management Plan
 |  |
| 1. EMP includes a technical basis document and an emergency management program plan.
 | * Jefferson Lab Technical Basis Document for Emergency Planning
 |  |
| 1. EMP includes procedures relevant to accelerator operations.
 | * Jefferson Lab Operations Directives and Operations directives supplements
 |  |
| 1. EMP addresses onsite and offsite hazards (if applicable) and associated impacts for both normal operations and credible accidents.
 | * Emergency Management Plan
* Jefferson Lab Technical Basis Document for Emergency Planning
 |  |
| 1. Jefferson Lab EMP benefits from programmatic lessons learned.
 | * Interview Jefferson Lab emergency management (EM) manager and Operations Staff for suitable examples of lessons learned and familiarity with related changes to lab policy/practice
 |  |
| 1. Jefferson Lab effectively utilizes mutual aid relationships.
 | * Discuss with Jefferson Lab EM Manager (and interview City of Newport News, if possible) to verify
* View training materials provided by Jefferson Lab to City, Newport News
 |  |
| 1. Accelerator Operations personnel have an effective understanding of EM.
 | * Interview selected Jefferson Lab Accelerator regarding roles in EM program to verify:
1. Familiarity with safety documentation
2. Understanding of credible scenarios
3. Understanding and mutual aid relationships
 |  |
| 1. Accelerator Operations personnel have an effective understanding of the application of programmatic lessons learned.
 | * Conduct one or more lines of inquiry:
1. Conduct tabletop exercise
2. Participate in a table top discussion with accelerator personnel
3. Review a previous event for effective application of lessons learned
 |  |
| 1. Observe function of site-wide notification system.
 | * Observe Tornado warning siren test Also check effectiveness of voice notification system.
 |  |
| 1. Determine adequacy of emergency response program to support commissioning and routine operations.
 | Basis for decision | Sign off |

## C16 Credited Controls (CC)

**Objective:**

Verify that the Credited Controls identified in the Accelerator Safety Envelope (ASE), necessary for the respective commissioning phase or operations, are effectively in place (installed, operational, managed, etc.). Verify that defense-in-depth controls are managed in a similar manner but using a graded approach. Verify that the configuration of Credited Controls, their system interfaces, and the supporting processes, procedures, and records are managed consistent with the DRAFT Accelerator Facility Safety Implementation Guide for DOE O 420.2C, SAFETY OF ACCELERATOR FACILITIES (August 2012).

**Criteria:**

Credited Controls identified in the Accelerator Safety Envelope (ASE), necessary for the respective commissioning phase or operations, are effectively in place (installed, operational, managed, etc.). The configuration of the Credited Controls and any related procedures, processes, training, records, etc. are managed. Configuration Management is applied to Credited Controls and defense-in-depth controls on a graded approach.

**Approach:**

**Record Reviews:** Review installation records, test procedures, commissioning records for Credited Controls where applicable. Review records and procedures associated with the maintenance, operations, and function of Credited Controls.

**Interviews:** Interview Jefferson Lab Engineering Department, Safety Systems Group Staff, Operations Staff, and SCMB members regarding the installation, maintenance, and operation of configuration management of Credited Controls.

**Performance Demonstrations:** Physically observe Credited Controls installed in situ. Where possible, observe the function/actuation (or the result of actuation) of Credited Controls. Observe selected Accelerator Operations interfaces (software, certification procedures, etc. NOTE: This will also be addressed in part in CRAD-LOIs for Software QA, Operations Training and Qualifications, and Accelerator Safety Envelope.

|  |
| --- |
| **Credited Controls (CC)****Lines of Inquiry, Status/Evidence and ARR Notes** |
| **LOI** | **Status/Evidence** | **ARR Reviewer Notes** |
| 1. Verify that Credited Passive, Active, and Administrative Controls in ARR Plan [Appendix 6](#_Appendix_6:_) are installed and operational.
 | **Status:**   **Evidence:** * In-situ observation of installed Credited Controls
* Observation of function/actuation of selected Credited Controls
 |  |
| 1. Verify that Credited Passive, Active, and Administrative Controls in ARR Plan [Appendix 6](#_Appendix_6:_) are properly managed.
 | **Status:**   **Evidence:** * SCM CRAD-LOI results
* Observe Accelerator Operators interact with Safety System (actuate and verify)
* Discuss how off-normal Safety System function is managed
* Observe the results of safety system certification
* Discuss Accelerator Operations/Safety Systems Group/RadCon Group interactions
 |  |
| 1. Verify that defense-in-depth controls also have Configuration Management applied on a graded approach.
 | **Status:**   **Evidence:**  |  |
| 1. Determine adequacy of Credited Controls to support commissioning and routine operations.
 | Basis for decision | Sign off   |

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